DURHAM
16236

November 9, 2018

SPECIAL PROVISION

AMENDMENT TO SECTION 520 -- PORTLAND CEMENT CONCRETE

Item 520.00001 – Ultra-High Performance Concrete

This special provision provides for ultra-high performance concrete and neither amends nor modifies the provision of this section except as noted below.

Add to Description:

1.1.2 This work shall consist of furnishing all materials, batching, mixing, placing, finishing, curing, and grinding field-cast ultra-high performance concrete (UHPC) at locations shown on the plans in accordance with these specifications.

Add to Materials:

2.12 Ultra High Performance Concrete.

2.12.1 All UHPC material shall be Ductal® JS1000 supplied by LafargeHolcim (Lafarge). Contact information for the UHPC material supplier is:

Paul White
Bridge Engineering Manager, UHPC/Ductal
LafargeHolcim
8700 W Bryn Wawr Ave
Suite 300
Chicago, IL 60631
Office (773) 355-4464; Mobile (773) 329-6569
Email: paul.white@lafargeholcim.com

2.12.2 Mix Design. A minimum of 30 days prior to the UHPC placement the Design-Build Team shall submit the concrete mix design to the Bureau of Materials and Research for approval. No concrete placement shall be started until the mix design is approved.

2.12.2.1 All UHPC shall satisfy the following minimum compressive strengths tested in accordance with ASTM C39:

Days	Compressive Strength
4	14,500 psi
28	21,700 psi (for information only)

2.12.3 Work Plan. A minimum of 30 days prior to placement of UHPC the Design-Build Team shall submit a work plan to the Engineer for approval in accordance with 105.02. The work plan shall include, but not necessarily be limited to:

1. Batching and mixing sequence. Include the order and time of introduction of the UHPC materials and the mixing time.
2. Sequence and schedule of UHPC placement operations. Include placement drawings with location of bulkheads, and stages if staged construction.
3. Surface preparation for adjacent concrete surfaces against which the UHPC will be cast. Include method for achieving and maintaining a saturated-surface-dry condition up to the time of placement of UHPC.
4. Number, location and details of all equipment used to batch, mix, and place UHPC (mixers, concrete buggies, etc.).
5. Location of UHPC material storage areas.
6. Working drawings and calculations for all formwork.
7. Curing procedures. Include minimum UHPC cure time and minimum strength requirements prior to grinding.
8. Testing procedures.
9. Quality control procedures for verification of mix uniformity.
10. Details of equipment used to grind areas not included in Item 628.5 – Diamond Grinding Concrete Pavement, such as bridge deck brush curbs, deck areas near curb lines and at ends near plug joints, and timeline for grinding after UHPC placement.

2.12.4 Storage. The Design-Build Team shall properly store all UHPC materials in accordance with the recommendations from Lafarge in order to protect materials against loss of physical and mechanical properties.

Add to Construction Requirements:

3.13 Ultra High Performance Concrete.

3.13.1 Forming, batching, mixing, placing and curing of all UHPC shall be in accordance with the recommended procedures by Lafarge and the approved work plan.

3.13.2 The Design-Build Team shall arrange for a representative of Lafarge to be on site during setup, batching, mixing, and placement of all UHPC. The representative shall be knowledgeable in the supply, batching, mixing, transporting, placement, and curing of UHPC.

3.13.3 The Design-Build Team shall provide a minimum of two portable batching units for mixing of the UHPC materials.

3.13.4 The Design-Build Team shall provide for maintaining UHPC curing temperatures, in accordance with recommendations from Lafarge including: insulation; heating; and ice.

3.13.5 All construction loads that will be applied to the prefabricated bridge units during placement and curing of UHPC shall be included in the erection plan submitted in accordance with 550.3.21.11.

3.13.6 Pre-Pour Meeting. Prior to placement of UHPC the Design-Build Team shall arrange for an onsite meeting between representatives of Lafarge, the Design-Build Team, and the Department. The objective of the meeting will be to clearly outline the procedures for batching, mixing, transporting, placing, and curing of UHPC.

3.13.7 The installation of all formwork shall be in accordance with the approved work plan and the recommendations of Lafarge. All forms shall be constructed from plywood and shall be coated to prevent absorption of water.

3.13.7.1 UHPC exerts 1 psi per vertical foot elevation change. All forms shall be properly sealed to prevent loss of material and designed and constructed to resist the hydrostatic pressure from UHPC in the unhardened state.

3.13.8 All concrete surfaces against which UHPC will be cast shall be cleaned of all material which may prevent bonding, such as grease, dust, or dirt. Surfaces shall be pre-wetted to achieve and maintain a saturated-surface-dry condition up to the time of placement of UHPC with the use of burlap or other approved methods.

3.13.9 Placement of UHPC shall be in accordance with the procedures recommended by Lafarge to ensure the elimination of air pockets. A 1/4 inch (minimum) over pour above final elevation is required for all UHPC placements.

3.13.10 Surface grinding shall not be performed until approved by Lafarge (typically within two days of placement). If significant fiber reinforcement pullout is observed during grinding operations, grinding shall be suspended and not resumed until approved.

3.13.11 The bridge deck shall not be opened to traffic until UHPC has achieved a minimum compressive strength of 14.5 ksi.

3.13.12 Compressive Strength Testing. Concrete compressive strength testing in accordance with ASTM C39 shall be performed following each day of UHPC placement. 9 specimens, 3 inch diameter by 6 inches shall be tested. Three specimens shall be tested to confirm the achievement of 14.5 ksi compressive strength prior to opening the bridge to traffic. Three specimens shall be tested at 28 days to verify final strength. The remaining three specimens shall be treated as reserves. All specimens shall be tested at an approved testing lab.

3.13.13 Flow Testing. Each batch of UHPC shall be tested for slump flow in accordance with ASTM C1437. The tests shall be conducted using a mini-slump cone. The slump flow of each batch shall be between 7 and 10 inches. If the slump is not within this range Lafarge shall be consulted and a new batch mixed if required. Water shall not be added to increase the slump. Additives to adjust the slump shall only be used as directed by Lafarge. The slump for each batch shall be recorded and a copy of this information given to the Department.